



FACT SHEET

COMPONENTS: HEATING (FURNACE)

Description

Gas furnaces are the dominant method of providing heat for houses in the United States. A wide variety of units are available from all manufacturers. The efficiency of a furnace is measured by its Annualized Fuel Utilization Efficiency (AFUE). The federal minimum is 78 AFUE, but most units commonly exceed 80 AFUE and units are available with ratings as high as 97 AFUE. Two categories of furnace dominate the market: power combustion furnaces with efficiencies in the 80-82% range, and condensing furnaces of 89 AFUE and higher. The following comparative analysis identifies the relative economic, energy, and environmental implications of furnaces.

Recommendations

General Guidelines

- Install a 90% or better AFUE furnace.
- Properly size the furnace for the required heating load
- If installed in conjunction with air conditioning use a 13 SEER or better Air Conditioner
- Use a digital programmable thermostat to maximize the efficiency of heating and cooling systems. See Component: Programmable Thermostat for more information.

Heating Alternatives

alternatives	cost	AFUE	estimated annual energy cost/sf-habitable	IAQ	practice
power combustion furnaces	\$700	80	\$0.33	typical	standard
condensing sealed combustion	\$1,300	92	\$0.30	better	standard
condensing sealed combustion	\$2,500	96	\$0.28	better	standard

Cost estimates for furnace units based on upflow, 100,000 Btu/h units. The energy model is a Minnesota code base zone 2, with wood siding, 15% window-to-floor area, unshaded windows with double low-E argon glazing, distributed equally with regard to orientation, AFUE furnace as noted, and 10 EER air conditioning. Cost information is gathered from manufacturer's information. Energy modeling was conducted on Visual DOE 3.1.

Criteria Summaries

Cost: Furnace cost is primarily impacted by three things; size, measured in Btu/h output; efficiency, measured in AFUE; and unit configuration, up, down, or horizontal flow. A furnace with higher efficiency results in an increase in initial cost, but reduces energy consumption and operating costs. An 80 AFUE rated furnace costs \$700 for the unit. A 92 and 96 AFUE units have an average cost of \$1300 and \$2500 respectively. A \$600 premium is paid between the 80 AFUE and the 92 AFUE units which represents an increase of \$50 per 1% increase in efficiency over this range. Using this same rate of increase, improving efficiency from 92 AFUE to 96 AFUE would cost \$300. However, the threshold of affordability and energy conservation diverge at approximately 92 AFUE after which costs rise rapidly for small return in energy efficiency.

alternatives	cost	AFUE	estimated annual energy use (therms)	estimated annual energy cost/sf-habitable	estimated annual energy cost	estimated 20 year energy cost
single stage	\$700	80	677	\$0.33	\$288	\$5,760
condensing sealed combustion	\$1,300	92	644	\$0.30	\$255	\$5,100
condensing sealed combustion	\$2,500	96	635	\$0.28	\$246	\$4,920

Cost estimates for furnace units based on upflow, 100,000 Btu/h units. The energy model is a Minnesota code base zone 2, with wood siding, 15% window-to-floor area, unshaded windows with double low-E argon glazing, distributed equally with regard to orientation, AFUE furnace as noted, and 10 EER air conditioning. Cost information gathered from manufactures information. Energy modeling was conducted on Visual DOE 3.1.

Energy: The highest efficiency rated furnaces lead to the least energy consumption and the lowest energy costs. A 96 AFUE rated furnace is 16% more efficient then a standard 80 AFUE unit. This results in energy savings of \$840 over a 20 year period. A 92% efficient unit will save \$660 over a 20 year period, essentially paying for the difference between it and the 80% efficient unit. Energy savings may be greater depending on location, and living patterns. Larger homes and homes that are leaky will have quicker paybacks for increased efficiencies. Efficiency can also be compromised by complex and leaky duct work.

IAQ: The air filter in a residential furnace removes particulates from the air passing through it. Regular replacement of the air filter is essential to maintain good indoor air quality within a home and continued efficient operation of the furnace. As with any combustion appliance, proper venting, installation, and maintenance is essential to avoiding carbon monoxide building up inside the home due to backdrafting. Sealed combustion units avoid this issue entirely by isolating combustion from the indoor environment.

Expected Product Life: Residential furnaces typically last 18 years. Early high efficiency furnaces suffered from reliability problems causing increased maintenance costs and early replacement, but current models have improved reliability. Frequent starting and stopping, also known as short cycling, can shorten useful life, and reduce efficiency.

Practice: Gas furnaces are standard practice, and the most common choice for residential heating.

Reminder: Proper maintenance of the heating system is critical to its longevity. Change the filters at least twice a year or according to the manufacturer's suggested guidelines.